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The Profitability and Credit Risk of the Egyptian Banking Sector: Do Financial Technology Entrants have an Impact?

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The Profitability and Credit Risk of the Egyptian Banking Sector: Do Financial Technology Entrants have an Impact?

الربحية والمخاطر الائتمانية للقطاع المصرفي المصري: هل للشركات الناشئة في مجال التكنولوجيا المالية تأثير؟

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Abstract:

This paper examines the impact of fintech on the profitability and credit risk of 20 banks in Egypt for the period from 2017 to 2021. ROA and ROE are used to measure profitability in addition to Z-score as a measure of credit risk. Moreover, new fintech indicators are employed in this study, as measured by the growth in fintech funding volume, growth in the number of fintech startups, and growth in the number of fintech funding deals. Fintech has demonstrated its impact on the profitability and level of credit risk in banks in different countries. Nevertheless, to the authors' knowledge, the impact of fintech startups on the profitability and credit risk level of the banking industry has not been examined before in Egypt. Since Egypt's fintech sector has recently experienced rapid growth, it becomes inevitable to examine its impact on one of the vital industries in the Egyptian economy - banking industry. Our findings support the significant impact of the examined fintech measures on bank profitability, but not on bank credit risk.

Keywords: Bank Profitability; Bank Credit Risk; Fintech; Egypt; Fintech Startups.

المستخلص:

تتناول هذه الدراسة تأثير التكنولوجيا المالية على الربحية ومخاطر الائتمان لـ ٢٠ بنكًا في مصر للفترة من ٢٠١٧ إلى ٢٠٢١. ويتم استخدام العائد على الاستثمار والعائد على حقوق المساهمين لقياس الربحية بالإضافة إلى Z–score كمقياس لمخاطر الائتمان. يتم استخدام مقاييس جديدة للتكنولوجيا المالية في هذه الدراسة، مقاسة بالنمو في حجم تمويل التكنولوجيا المالية، والنمو في عدد الشركات الناشئة في مجال التكنولوجيا المالية، والنمو في عدد صفقات تمويل التكنولوجيا المالية. لقد أثبتت التكنولوجيا المالية تأثيرها على الربحية ومستوى مخاطر الائتمان في البنوك في مختلف البلدان .ومع ذلك، وعلى حد علم الباحثين، لم يتم دراسة تأثير الشركات الناشئة في مجال التكنولوجيا المالية على الربحية ومستوى مخاطر الائتمان في القطاع المصرفي من قبل في مصر. ونظرًا لأن قطاع التكنولوجيا المالية في مصر شهد مؤخرًا نموًا سريعًا، فقد أصبح من الضرورة دراسة تأثيره على إحدى القطاعات الحيوية في الاقتصاد المصري – القطاع المصرفي. تدعم النتائج التي توصلت إليها هذه الدراسة التأثير الكبير لمقاييس التكنولوجيا المالية على ربحية البنوك، وعدم تأثيرها على مخاطر الائتمان المصرفي.

الكلمات المفتاحية: ربحية البنك؛ مخاطر الائتمان للبنوك؛ التكنولوجيا المالية؛ مصر؛ شركات التكنولوجيا المالية الناشئة.

1. Introduction

Fintech has received global attention as it is seen as one of the technologies that is expected to revolutionize the banking industry (Wonglimpiyarat, 2017). Therefore, governments and central banks around the world have paid attention to fintech as they created policies and regulations to support the development of fintech firms. Similarly, the Central Bank of Egypt is initiating an investment vehicle with capital of EGP 1 billion to fund and support Fintech and Fintech-enabled startups (FinTech Egypt, 2022). This investment vehicle is implemented through the investment arms of some commercial banks in Egypt. The objectives of the investment vehicle are to increase investment in fintech entrants that are in the early stage, promote digital transformation to increase financial inclusion, and activate the fintech industry in the market. Moreover, the investment vehicle aims to support innovative banking and financial services and to make Egypt a regional hub for the fintech industry (FinTech Egypt, 2022). The Central Bank of Egypt acknowledges that promoting innovation is essential to transform Egypt's financial and banking landscape.

In addition, Egypt is rated second in the MENA area in terms of the number of fintech funding deals, accounting for 23% of all MENA fintech funding deals. Furthermore, Egypt ranks second in the MENA area in share of fintech funding volume, accounting for 21% of total funding in the region. In the previous two years, there has been a significant increase in the number of fintech firms operating in Egypt. Egypt now boasts approximately 112 Fintech and Fintech-enabled firms, as well as 18 ecosystem facilitators (Central Bank of Egypt, 2022a).

Moreover, according to the Central Bank of Egypt (2022b), Egypt is ranked the fourth African top country in fintech investments. The fintech industry has grown from just two firms in 2014 to 112 startups by 2021 as illustrated in Figure 1.1. Almost 70% of Egypt's fintech entrants are in the final stage, which means their solutions are now in the market; as a result, this reflects the

rapid rise of new companies in recent years (Central Bank of Egypt, 2022a). On the other side, 30% of fintech startups are in the planning stage, including those still working on advanced concepts and those with a prototype. Moreover, according to Central Bank of Egypt (2022a) and as illustrated in Figure 1.2, the majority of fintech firms engage in the payments and remittance industry, accounting for 34 startups which represents 30% of total startups. Therefore, payments and remittances are Egypt's major fintech sector. As a result, banks in Egypt should reconsider their competitive advantage in order to adapt to the new innovative market. According to Jaki and Marin (2019), the progress of information technology and the stresses associated with rivalry that fintech companies create affects bank stability.

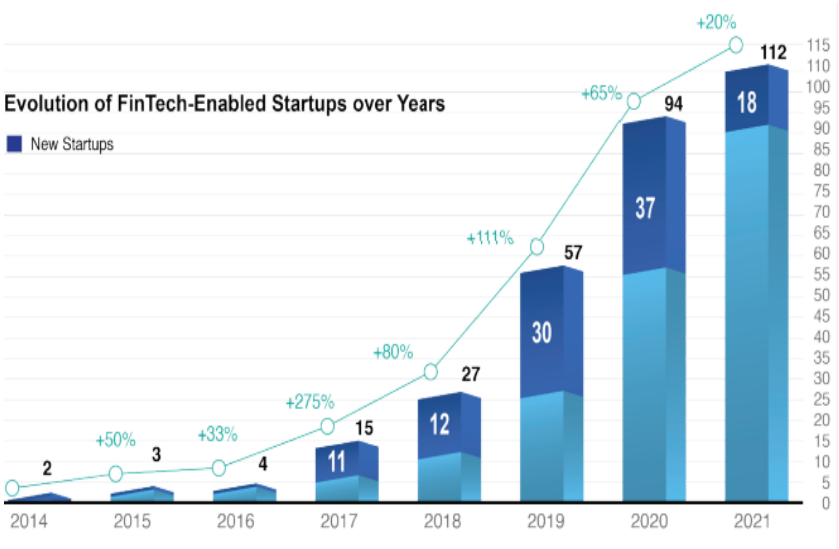

Figure 1.1 Evolution of Fintech Startups over years in Egypt (Central bank of Egypt, 2022a)

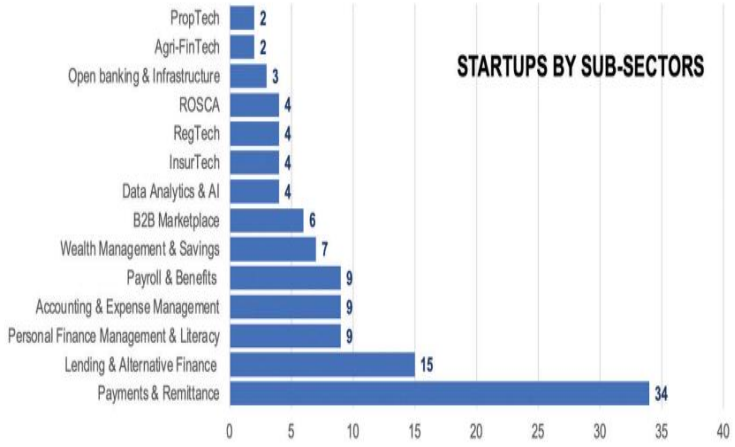

Figure 1.2 Number of Fintech Startups in each sub-sector in Egypt (Central Bank of Egypt, 2022a)

Researchers have long been interested in topics such as bank profitability and credit risk; thus, several researchers investigated both internal and external factors that influence bank profitability (Al-Qudah & Jaradat, 2013; Ahmad & Matemilola, 2013; Petria et al., 2015; and Abobakr, 2018). Although the fintech industry is expanding globally and their presence puts competitive pressure on the banking system, these new technological advancement factors have not been thoroughly discussed in the literature, particularly in Egypt. Investigating this relationship can help Egypt build a stronger banking system that can increase profitability and reduce credit risk.

A number of recent studies investigated the impact of fintech on bank profitability and credit risk. Those studies took place in both developed and developing countries. However, to the best of the researcher's knowledge, no studies in Egypt specifically addressed the influence of fintech firms on bank profitability and credit risk. Studies that have addressed the fintech topic in Egypt to date examined its impact on other

dependent variables, such as El-Gohary (2019), who examined the influence of fintech on the facilitation of e-government services, and Hussein (2020), who discussed the impact of fintech on financial inclusion in Egypt.

Furthermore, the fintech measures employed in this study were not previously used by Egyptian researchers. Accordingly, this study is conducted to fulfill the existing gap regarding the lack of studies in Egypt. Hence, the study examines the impact of fintech firms on bank profitability and credit risk in Egypt for the period 2017-2021. This is achieved by examining:

- The impact of the growth in fintech funding volume on bank profitability and credit risk
- The impact of the growth in the number of fintech startups on bank profitability and credit risk
- The impact of the growth in the number of fintech funding deals on bank profitability and credit risk

2. Literature Review

Authors address the topic of 'fintech' in two ways in the literature. The first refers to fintech as "firms," which are mostly firms and startups that use advanced technology to provide financial services (Fintech Regulatory Aspects Working Group, 2019). Fintech is described as "companies or representatives of companies that combine financial services with innovative software technology" by Dorfleitner et al. (2017). However, such a definition is thought to be insufficient since it excludes incumbents that constantly utilise technology to improve financial services, hence incumbents can be termed "fintech firms."

Fintech firms provide services such as loan and saving, payment processing, investment management, financial consulting, and insurance. Fintech companies, according to Navaretti et al. (2017), offer services similar to banks but more efficiently due to advanced technology. Banks, for example, provide loans; similarly, some fintech companies use crowdsourcing to transform client money into investments and loans. As a result, Navaretti et al. (2017) argue that fintech firms are distinct from banks because they are new to the financial sector and coexist with established banks. It has become globally accepted that fintech firms are not yet direct competitors to banks. The difference is that clients perceive fintech firms' products to be more convenient.

According to the second stream of literature addressing fintech, fintech is about applying the latest technology; in other words, it is about employing the latest technology to upgrade and improve financial services (Thakor, 2020). For example, traditional banks might use artificial intelligence or machine learning to improve their financial services. Fintech is defined as "technology based financial innovations, that can result in new business models, applications, processes or products associated with a material effect on financial markets and institutions and on the provision of service" (Basel Committee on Banking Supervision, 2018).

2.1 Fintech and Bank Profitability

Li et al. (2017) studied the impact of funding fintech startups on the share prices of retail banks. The study measures fintech startups in terms of funding volume and number of funding deals, while covering a sample of 47 incumbents US retail banks for the period 2010-2016. The findings show a positive association between fintech funding growth rate and the ratio of bank deals to stock prices. The study reveals symmetry between fintech and traditional banking; nevertheless, the results on the sector level are insignificant and show diverse relationships. However, according to Li et al. (2017), the results of the study are spurious as the fintech industry is new and the study timeframe is short.

Kou et al. (2021) assess European bank investments in fintech. Sensitivity analysis was conducted by considering six distinct cases. The study outlines the most crucial fintech-based investment opportunities that could help banks perform better. The results show that fintech enhances the financial performance of European banks through enhancing the competitive advantage of banks. The study identifies 'competitive advantage' as the most crucial determinant of fintech.

In addition, Haddad and Hornuf (2021) investigates the effect of fintech firms on financial institution profitability and the likelihood of default. The study sample composed of banks of 87 countries and 12,549 fintech startups, covering the period from 2005 to 2018. To test the hypotheses, Haddad and Hornuf (2021) used the two-step Generalized Method of Moments (GMM) system dynamic panel estimator. The findings indicate that fintech formations reduce variations in banks' stock returns. Accordingly, the findings of the study designate that financial institutions should monitor the growth of fintech startups as they positively affect the performance of financial institutions as well as the sector as a whole.

Moreover, Chhaidar et al. (2021) examines the impact of fintech investments on banks' financial performance, while exploring whether bank size impact the performance in the context of digitisation. The study employs the Fully Modified

Ordinary Least Squares (FMOLS) model, using a sample of 23 banks in Europe spanning the years 2010 to 2019. According to the findings of the study, fintech is favourably and significantly related to bank profitability, demonstrating that the larger the banks' digital involvement, the better their financial performance. According to Chhaidar et al. (2021), bank size is a moderator factor in determining the impact of fintech on profitability. Therefore, major financial institutions gain more from fintech investments as it improves their profitability.

Furthermore, Wonglimpiyarat (2017) studies fintech and its transition in the banking industry. The study is concerned with the e-payment services in Thailand and the sample consists of five main banks in Thailand while using the case study approach. Wonglimpiyarat (2017) claims that fintechs positively affect the efficiency of banks' financial services and that non-financial institutions are expected to speed up fintech innovation that will let them compete with banks, resulting in a negative relationship. Moreover, Meng et al. (2020) states that the competition between banks and fintechs leads to an industrial competition effect that will encourage banks to offer better and improved services to the economy.

Additionally, Chen et al. (2017) investigates the transition of banks in China from traditional banking to mobile internet finance. The research focuses on the impact of fintech development in areas such as internet in smartphones and tablets, big data, cloud services, blockchain technology, and engines of search on the financial industry. It is concluded that the development of fintech results in drastic alterations to the financial industry and it is estimated that fintech will knock over banks, forcing them to adopt a new business model to upgrade services they offer. This research employs a case investigation to analyze and contrast Citibank and the Industrial and Commercial Bank of China (ICBC). Finally, the report suggests an "aeroplane mode" for Citibank in reference to their new directions, and an "electric vehicle mode" for ICBC in response to the significant technological transformation and upgrade. Moreover, Chen et al.

(2017) expects that 'technology power' will be the main notion for banks in the future.

Moreover, Ibrahim (2018) studies the effect of financial technology on the financial performance of commercial banks in Kenya. Financial technology was measured by the number of transactions through internet banking and mobile banking. The regression results reveal a significant positive effect of fintech on the financial performance of banks. In addition, the study recommends that commercial banks should continue investing in financial technology.

Furthermore, Phan et al. (2020) examines the influence of financial technology firms on bank performance in the Indonesian market as Indonesia witnesses an impressive growth in fintech. The sample consists of 41 banks excluding unlisted banks. Fintech firms are measured as the number of fintech firms founded each year over the period 1998 to 2017. The number of fintech firms founded averages 7 per year. Also, bank performance was measured using return on equity, return on assets, and net interest margin. A two-step generalized method of moments (GMM) system dynamic panel estimator is used to test the null hypothesis that fintech firms negatively affects banks' performance. Finally, the results support the null hypothesis proving that fintech firms are negatively impacting bank performance. Moreover, robustness tests and additional tests are applied, such as effects of the Global Financial Crisis, sensitivity to bank characteristics, and the use of alternative estimators to test the hypothesis and the results remained the same.

In addition, Marlina (2020) analyzes the effect of financial technology on banking profitability regarding banks listed in the Indonesian stock exchange. Financial institutions in the banking industry are affected by the presence of fintech companies. The study analyzes the differences in performance of 43 listed banks using ROA, NIM and operational expenses, and operating income before and after the cooperation with fintech firms for the period 2014-2018. However, 9 banks only cooperate with fintech firms. The results of the study reveal that there is no difference in the

profitability of banks before and after cooperating with fintech firms.

Additionally, a study conducted in Kenya examines the impact of financial technologies on the financial performance of tier two banks (Mokaya, 2020). Financial technology was addressed in terms of online banking, mobile banking, and automated teller machines. The study adopted the descriptive causal research design method and the sample composed of 9 tier two banks in Kenya. A multiple regression model was used to establish the relationship between mobile banking, online banking, and ATM banking on the ROA of the tier two banks. The result shows that financial technology has a positive impact on the performance of tier two banks in Kenya. Therefore, Mokaya (2020) recommends that commercial banks shall adopt financial innovations as it positively affects their performance.

Moreover, Abu Karsh and Abufara (2020) studies the impact of fintech firms on traditional banking industry. The procedure used in the study is to examine previous research that have identified whether fintech firms are growing due to availability of digital technology and to examine if there has been negative impact on financial performance of banks. Kenyan and Lithuanian banking sectors is the sample of the study. Results show that banks' profitability changes when there are fintech firms in the country and when banks adopt financial technology into their activities. However, from statistical analysis, results reveal that fintech has an insignificant relationship on profitability of the banking sector.

Furthermore, Monika et al. (2021) studies the impact of fintech development on profitability of state-owned and private Islamic banks in Indonesia. The study uses ROA as the profitability measure and data accumulations of peer-to-peer lending transactions as measure of fintech. Also, panel data analysis was used on 10 Sharia commercial banks for the period from 2017 to 2019. Monika et al. (2021) claims that the development of fintech has a negative effect on the profitability

of state-owned Islamic banks and a positive effect on profitability of private Islamic banks.

In addition, the influence of fintech firms on bank's profitability in China is recently examined by Lv et al. (2022). The study theoretically expounds on how fintech impacts banks' financial operations. Then, for the period 2011-2020, they developed the Error Correction Model (ECM) and integrated it with the Granger causal link test. The results of the study reveal that bank's profitability measured using ROE grows in connection with fintech advancement, growth in bank assets, the increase in net interest margin, cost control, and reduction in credit risks (non-performing loans). According to Lv et al. (2022), fintechs and banks' profitability has a 'U' shaped relationship meaning that in the initial stage, fintechs negatively impact banks' profitability, then the advantages of fintech gradually increases which increases the profitability of banks in the middle and later stages.

Regarding Egypt, El Gohary (2019) studies the impact of financial technology including e-payment services, ways of payment, bills e-payment and bank accounts with e-government on facilitating e-government services in Egypt. Facilitating e-government services is addressed in terms of accessibility, availability, responsiveness, and efficiency. A survey was conducted on 400 respondents in Egypt in order to determine which fintech service can affect any of the dimensions of e-government facilitation. Results show that bank accounts with e-government have no effect on facilitating e-government services, while the remaining items prove to have an effect on some dimensions and have no effect on others.

Moreover, Hussein (2020) investigates the impact of financial technology on financial inclusion in Egypt. The study examines the readiness of the Egyptian government to promote financial technology and new technologies to achieve financial inclusion. According to Hussein (2020), the Egyptian government shall pay more attention to enhance financial literacy to achieve financial inclusion. This could be achieved by filling the supply

and demand gap through different players such as banks and fintech startups that have the power to introduce innovative services to meet needs. The research sample size is 9,084 individuals surveyed from Egypt, United Arab Emirates, Kenya, Jordan, Saudi Arabia, Kuwait, Bahrain, Tanzania, and Ethiopia. Findings reveal that fintech has a robust influence on financial inclusion.

Consequently, several studies in the finance literature examine the impact of fintech on Banks' financial performance in various international markets. Most of the studies state the significant impact of fintech on banks' profitability. Nevertheless, the results are inconsistent in terms of the direction of the relationship.

2.2 Fintech and Credit Risk

There are few studies that examine the impact of fintech on banks' credit risk. According to Shen and Guo (2015), the advancement of fintech leads to alteration in the bank model of business and operation; thus, banks' risk-taking activities will tend to increase. The study was conducted on 36 commercial banks in China for the period 2003-2013. Shen and Guo (2015) argue that the influence of fintech advancement on banks' risky deals represents a 'U' shaped relationship, meaning that risk-taking behavior will first decrease and then increase.

According to Wang and Wu (2018), fintech aggravates the systemic risk of the banking industry to some extent. The study examines the influence of fintech mechanism on the systemic risk of the banking industry in China, also the influence degree is empirically tested. In addition, Qiu et al. (2018) studies the impact of fintech on traditional banking behavior in China. The study demonstrates that the development of fintech has altered the financial framework and risk attitude of banks. Banks' willingness to take risks has increased as profits have declined and competition has increased. Nevertheless, this impact indicates that banks risk management levels significantly improved.

Further studies examine the relationship between fintech and bank risk-taking. Liu et al. (2020) studies the impact of

fintech on commercial banks' risk-taking in China. The study uses a multivariate panel regression model on a panel data of 130 commercial banks from 2007 to 2017. Fintech is measured using Fintech Index that they developed using text mining technology. The results show that the relationship between fintech and bank risk-taking represents a 'U' shape relationship, first rises then falls. At the early stage of fintech development, fintech increases commercial banks risk-taking. However, as the technology matures, fintech reduces management costs and enhances risk control which then leads to decrease in the banks' risk-taking level.

Moreover, Pierri and Timmer (2020) claims that the advancement of fintech improves the information asymmetry of banks, strengthens the stability of their systems, and advances the risk management levels of the bank. Furthermore, Deng et al. (2021) studies the impact of fintech on banking risk-taking in China. The study was conducted on 155 small and medium-sized banks for the period 2011-2016 and the study used a benchmark regression model. The results showed that the development of fintech has significantly reduced the level of bank-risk taking.

Furthermore, Liu (2021) studies fintech and systemic risk in commercial banks of China. The study examined both small and medium sized banks. It concluded that fintechs play a less significant role in the systemic risk transfer of Chinese state banks. On the other hand, Haddad and Hornuf (2021) examined the influence of fintech firms on banks' financial performance and level of credit risk. The study was conducted on eighty-seven markets for the period 2005-2018. The research found that fintech startups reduce the financial firms' vulnerability to systemic risk. Therefore, it is recommended that banks shall closely monitor the development of fintech startups as they improve financial stability. Accordingly, previous research indicates that fintech has a significant impact on bank credit risk, particularly in the short term. However, there is disagreement in terms of the direction of this impact.

As a result of the prior literature and as far as the researchers' knowledge, there is a dearth of studies undertaken in Egypt addressing the effect of fintech startups on bank profitability. Moreover, few studies have been conducted to examine the relationship between fintech and bank credit risk in developed countries. On the other hand, to the best of the researchers' knowledge, no study examined the relationship between fintech and bank credit risk in an emerging market such as Egypt. As a result, studying the influence of fintech on bank profitability and credit risk in Egypt is both practically and theoretically important.

3. Hypotheses Development

Technology evolves with time, and the characteristics of industries and products change as a result (Utterback & Afuah, 1997). For example, according to Cannon and Summers (2014), the hotel and taxi businesses transformed in response to the creation of online peer-to-peer platforms such as Airbnb and Uber. The same concept is used in the banking industry, where fintech entrants provide services similar to banks such as peer-to-peer lending and other services. As a result, it is expected that the banking industry would undergo a digital transformation as a result of fintech firms, which are regarded new entrants to the business (Yan et al., 2015; and Wang et al., 2015). The findings of prior studies, as illustrated in the literature review section, show that fintech entrants have a significant impact on bank profitability and credit risk in several developed and developing markets, excluding Egypt. To explain the relationship between fintech startups and banks, researchers use two theories: consumer theory and disruptive innovation theory.

3.1 Consumer Theory

According to Aaker and Keller (1990), consumer theory explains that new services (such as those provided by fintech firms) that are used in conjunction with an old service will be a complement to the old service. On the other hand, new services

that meet the same consumer demand will replace old services (such as those provided by banks). As a result, while the services supplied by fintech firms might benefit existing traditional banks in one situation, they would have a negative influence on bank performance in the other.

3.2 Disruptive Innovation Theory

According to Christensen (1997), the disruptive innovation theory asserts that new market entrants that employ new technology to provide more accessible and cost-effective services to clients increase competition and disrupt the industry. Thus, the financial structure and risk behavior of banks would change in response to the new competition. Consequently, the impact of fintech entrants on banks financial and risk performance would differ based on the banks response to the new competition.

Based on the two theories, the link between the performance of banks and fintech firms can be described in three cases: substitution effect, complementary effect, and no effect (Li et al., 2017). In the substitution effect, fintech firms are seen as substitutions to retail banks due to the firms' efficiency and quality of services. Fintech firms use cutting-edge technology to provide their services, as opposed to traditional banks, which continue to rely on outdated technology and are unable to incorporate innovative technologies rapidly (Laven & Bruggink, 2016). Fintech firms' efficiency in financial services applies to a variety of financial services, including lending, quick payments, investment and financial service advice, and asset management services (Villeroy de Galhau, 2016). In addition, fintech entrants have higher quality service than traditional banks as they have several methods to evaluate risk other than the credit score. Therefore, fintech firms can substitute traditional banks which could result in a negative impact on bank performance.

On the other hand, the complementary effect claims that fintech firms are complements to traditional banks. The reason behind this is that banks attempt to incorporate fintech firms' services into their operations by outsourcing the service, joint partnerships, or acquiring fintech startups (Juengerkes, 2016).

Therefore, banks are taking advantage of the fintech startups and benefiting from them, not disrupting them. In addition, banks' level of risk taking would increase as the profit of banks erodes and competition increases (Qiu et al., 2018). As a result, fintech entrants would benefit bank profitability and risk management.

Finally, the no effect relationship between bank performance and fintech startups suggests that fintech companies will create a new channel in the market, attracting clients who do not already deal with banks (Demos, 2016). For example, riskier startup companies seeking funding are more inclined to work with fintech firms than banks. Because fintech firms are small compared to large banks, it is difficult to discover a fintech firm that is a direct competitor to a bank (The Economist, 2015). As a result, fintech newcomers are unlikely to have a significant impact on banks' financial performance and risk management in countries where the banking industry is stable and large enough to compete.

Since the previous theories demonstrate that there is no consistent influence of fintech entrants on bank financial performance and risk management across all countries. The impact is determined by the type of the fintech services (complementary or new), the characteristics of the banks, and banks' response to the new competition created by fintech entrants. Consequently, as illustrated in the literature review section, there is no agreement in the previous studies on the direction of the impact of fintech firms on bank profitability and credit risk.

In addition, since the CBE acknowledges that promoting innovation is essential to transform Egypt's financial and banking landscape, the fintech industry is developing rapidly in Egypt in the past 5 years as shown in figure 1.1. Moreover, as shown in figure 1.2, there is several fintech sub-sectors in Egypt which results in diversity in the services offered by fintech startups. Furthermore, Egyptian banks responded to fintech entrants in several ways, such as joint partnerships, outsourcing new fintech services, and funding some fintech startups. As a result, it is

hypothesized that fintech entrants and fintech funding would have a robust impact on banks' financial performance and risk-taking behavior in Egypt.

Accordingly, the following hypotheses are developed:

H1: The growth in fintech funding volume has a significant impact on bank profitability in Egypt.

H2: The growth in the number of startups has a significant impact on bank profitability in Egypt.

H3: The growth in the number of fintech funding deals has a significant impact on bank profitability in Egypt.

H4: The growth in fintech funding volume has a significant impact on bank credit risk in Egypt.

H5: The growth in the number of startups has a significant impact on bank credit risk in Egypt.

H6: The growth in the number of fintech funding deals has a significant impact on bank credit risk in Egypt.

4. Research Methodology

4.1 Sample and Data

The target population of the study represents all banks operating in Egypt. According to the Central Bank of Egypt (2022b), the Egyptian banking sector is composed of 39 banks classified into commercial, Islamic, and investment banks. Due to unavailability of required data for several banks, the sample consists of 20 banks only which is considered a limitation in this study. The names of the 20 banks are displayed in table 4.1.

In addition, the econometric methodology used for all the models examined in this study is based on panel data analysis. Panel data analysis investigates the phenomena/situation continuously over the period that the phenomena runs its course (Saunders et al., 2009). Moreover, the sampling period of the study is from 2017 to 2021. This short sample-period is considered another limitation in this study; nevertheless, this period is chosen depending on the availability of data on fintech funding volume, number of startups, and number of fintech

funding deals in Egypt which are the measures of fintech (independent variable).

Table 4.1: Banks used in the sample

	Bank Name		
1.	Commercial International Bank (CIB)	**11.**	Al Ahli Bank of Kuwait (ABK)
2.	Bank du Caire	**12.**	Ahli United Bank
3.	Credit Agricole	**13.**	Abu Dhabi Commercial Bank
4.	Egyptian Gulf Bank	**14.**	Alex Bank
5.	Export Development Bank	**15.**	Arab African International Bank
6.	Housing and Development Bank	**16.**	Emirates NBD
7.	Qatar National Bank Al Ahli (QNB)	**17.**	National Bank of Kuwait
8.	Societe Arabe Internationale de Banque (SAIB)	**18.**	Abu Dhabi Islamic bank
9.	Suez Canal Bank	**19.**	Faisal Islamic Bank of Egypt
10.	Bank Misr	**20.**	National Bank of Egypt

4.2 Identification of Study Variables

Nine panel data regressions are conducted in this study as there are three dependent variables, which are two bank profitability measures and one credit risk measure in addition to three measures for the independent variable (fintech) that are examined separately in each regression model. According to Ommeren (2011), bank profitability can be measured by several ratios including return on equity, return on assets, and net interest margin as previously mentioned in chapter two. For this study, the ratios used to evaluate bank profitability are ROA and ROE. On the other hand, credit risk can be measured using Z-score, loan loss provisions ratio, non-performing loans ratio…etc. In this

study, Z-score is used to measure banks' credit risk.

To measure the impact of fintech which is the independent variable in the study, growth in fintech funding volume, number of fintech startups, and number of fintech funding deals are used. Fintech funding volume is the amount of funds given to fintech and fintech-enabled startups every year in Egypt by the Central Bank of Egypt, commercial banks, and other incubators. In addition, the number of fintech startups represents the number of new fintech startups founded every year. Furthermore, number of fintech funding deals represents the number of funding deals made every year. In addition, control variables are included in each regression model based on the findings of previous literature that state their robustness as determinants of each examined dependent variable. The data is collected from the Central Bank of Egypt (Central Bank of Egypt, 2022a). Refer to table 4.2 for definitions of the study examined variables.

Table 4.2: List of study variables

Variable	Definition	Measurement and References
Independent Variable: Fintech Firms Measures		
Fintech Funding Volume	Amount of funding to fintech and fintech-enabled startups in Egypt.	$Growth\ of\ fintech\ funding = Ln\ \frac{fintech\ funding\ \text{t}}{fintech\ funding\ \text{t-1}}$ (Li et al., 2017)
Number of Fintech Funding Deals	Represents the number of fintech firms that got funded.	$Growth\ of\ number\ of\ fintech\ deals = Ln\ \frac{number\ of\ fintech\ deals\ t}{number\ of\ fintech\ deals\ \text{t-1}}$ (Li et al., 2017)
Number of Fintech Startups	Represents the number of fintech startups founded every year.	$Growth\ of\ number\ of\ startups = Ln\ \frac{number\ of\ startups\ t}{number\ of\ startups\ \text{t-1}}$ (Haddad and Hornuf, 2021; Phan et al., 2020)

Dependent Variables: Bank Profitability and Credit Risk		
Return on Assets (ROA)	ROA assesses the effectiveness of banks in managing and utilizing its assets to generate profit.	$ROA = \frac{Net\ Income}{Total\ Assets}$ (Ibrahim, 2017; Haddad and Hornuf, 2021; Phan et al. 2020; El-Faham 2020; Abu Karsh and Abufara 2020; Chhaidar et al. 2022; and Mokaya 2020; Monika et al. 2021)
Return on Equity (ROE)	Measures profitability generated from the equity that shareholders invested.	$ROA = \frac{Net\ Income}{Total\ Equity}$ (Hassanien 2018; El-Faham 2020; Phan et al. 2020; Abu Karsh and Abufara 2020; Koroleva et al. 2021; Haddad and Hornuf 2021; Lv et al., 2022)
Z-score	Z-score is a measure of credit risk. It evaluates bank's risk exposure.	$Zscore = \frac{(ROA + Bank\ Capital)}{Standard\ deviation\ ROA}$ (Agoraki et al., 2011; Kohler 2014; Köhler 2015; Ghenimi et al., 2017; Deng et al., 2021; Di et al., 2021; Haddad and Hornuf, 2021)
Control Variables in All Regression Models		
Inflation rate (CPI)	Inflation rate is a macroeconomic variable that affects banks' activities.	$Growth\ of\ CPI = \frac{CPI\ \text{t} - CPI\ \text{t-1}}{CPI\ \text{t-1}}$ (Al Smadi and Al Wabel, 2011; El-Faham, 2020)
Net Interest Margin (NIM)	NIM assesses the bank's operational efficiency as it shows the bank's ability to generate interest income exceeding its interest expense.	$NIM = \frac{(Interest\ Income - Interest\ Expense)}{Total\ Assets}$ (El-Faham, 2020; Phan et al., 2020; Abu Karsh and Abufara, 2020; Haddad and Hornuf, 2021; Lv et al., 2022)

Deposits to assets ratio (TDTA)	It shows how much does the bank depends on deposits compared to total assets of the bank.	$TDTA = \frac{Total\ Deposits}{Total\ Assets}$ (Al-Qudah and Jaradat, 2013; El-Ansary and Hafez, 2015; Deng et al., 2021; Koroleva et al., 2021)
Expenses to revenues ratio (TETR)	It assesses the bank's operational efficiency.	$TETR = \frac{Total\ Expenses}{Total\ Revenue}$ (Abdeldayem and El-Sherbiney, 2018; Liu et al., 2020; Phan et al., 2020; Deng et al., 2021; Haddad and Hornuf, 2021)
Loans to Deposits ratio (TLTD)	Indicate the percentage of bank's loans that are funded using deposits. A measure of banks' liquidity.	$TLTD = \frac{Total\ Loans}{Total\ Deposits}$ (Al-Smadi and Al-Wabel, 2011; Al Qudah and Jaradat, 2013; Shihadeh, 2019; Liu et al., 2020; El-Faham, 2020)
Non-interest Income ratio (NIITI)	Measures banks' revenue diversification.	$NIITI = \frac{Non-interest\ income}{Total\ Income}$ (El-Faham, 2020; Deng et al, 2021;Di et al., 2021)
Money Supply (M2)	Money supply is the total money held by households and businesses in a country at a certain point in time.	Measured using M2 (%) (Deng et al., 2021; Liu et al., 2021)
Provisions to net loans (PNL)	provisions to net loans is used as a proxy for credit risk.	$PNL = \frac{Provisions}{Net\ Loans}$ (Phan et al., 2020)

4.3 Model Specifications

Regression Models 1-6:

$y_{it} = \beta_0 + \beta_1 FT_{tk} + \beta_2 CPI_{tk} + \beta_3 NITI_{itk} + \beta_4 NIM_{itk} + \beta_5 TETR_{itk} + \beta_6 TDTA_{itk} + \varepsilon_{tk}$

Where t = 1, …..,n covering the sample period from 2017 to 2021
i = number of examined banks
K = number of examined factors in each firm
y_{it} = bank profitability measures (ROA or ROE) for bank i at time t.
β_0 = intercept (constant)
FF_{tk} = fintech measures (fintech funding volume or number of fintech funding deals or number of fintech stratups).
CPI_{tk} = inflation measure.
$NITI_{itk}$ = non-interest income ratio.
NIM_{itk} = net interest margin.
$TETR_{itk}$ = expenses to revenues ratio.
TDTA = deposits to assets ratio.
ε_{tk} = random error term

Regression Models 6-9:

$y_{it} = \beta_0 + \beta_1 FT_{tk} + \beta_2 CPI_{tk} + \beta_3 NITI_{itk} + \beta_4 NIM_{itk} + \beta_5 TETR_{itk} + \beta_6 TLTD_{itk} + \beta_7 PNL_{itk} + \varepsilon_{tk}$

Where t = 1, …..,n covering the sample period from 2017 to 2021
i = number of examined banks
K = number of examined factors in each firm
y_{it} = bank credit risk measure (Z-score) for bank i at time t.
β_0 = intercept (constant)
FF_{tk} = fintech measures (fintech funding volume or number of fintech funding deals or number of fintech stratups).
CPI_{tk} = inflation measure.

$NITI_{itk}$ = non-interest income ratio.
NIM_{itk} = net interest margin.
$TETR_{itk}$ = expenses to revenues ratio.
$TLTD_{itk}$ = loans to deposits to ratio.
PNL_{itk} = provisions to net loans.
ε_{tk} = random error term

5. Results

5.1 Descriptive Analysis

The descriptive statistics presented in table 5.1 examines the mean, standard deviation, minimum values, and maximum values of the variables for the study period from 2017 to 2021 for the 20 studied banks in Egypt.

Table 5.1: Summary of the Variables Descriptive Statistics

Variable	Mean	Median	Min.	STD	Max.
ROE	.2011	.1713	.0393	.1128	.6043
ROA	.0206	.0179	.0028	.0139	.0698
Z-score	1.5909	1.5932	1.1074	.2674	2.2309
Growth in Fintech Funding	1.2936	.9250	-.1062	1.3649	3.4304
Growth in No. Fintech Startups	.1231	.1484	-.7205	.5845	.9163
Growth in No. Fintech Funding Deals	.5918	.4944	.1744	.4181	1.2039
CPI	.1046	.071	.054	.0621	.219
Provision/Net Loans	.0158	.0096	.0005	.0226	.0779
Expenses/Revenues	.8319	0.8489	.5803	.0867	.9768
Deposits/Assets	.8503	.8487	.7696	.03381	.9291
Loans/Deposits	.5015	.5033	.1207	.1406	.7375
Non-Interest Income/Total Income	.0951	.0858	.0197	.0444	.3071
Net Interest Margin	.0391	.0392	.0069	.0127	.0728

5.2 Regression Analysis Results

Hausman specification test was conducted for each regression model and the results were insignificant; thus, the null hypothesis that the slope coefficients of the fixed and random-effects models do not differ significantly cannot be rejected. Hence, the random-effect regression model is employed for all the nine examined regression models. In addition, depending on the VIF test, the results shall not be greater than 5 to have moderate multicollinearity (Daoud, 2017). In this study, two macroeconomic variables are highly correlated which are 'interest rate' and 'inflation rate' that are employed in the ROA and ROE regression models; therefore, interest rate is excluded from the examined regression models. Moreover, all variables examined in the paper are winsorized at 1% to remove any outliers (Leone et al., 2019).

Tables 5.2-5.4 present the regression results of the effect of each of the three examined fintech measures on Bank ROA. The R-square of the regression models represent the coefficients of determination, meaning that the ROA is explained by growth rate in fintech funding, number of fintech deals, and number of startups by approximately 79.41%, 78.66%, and 78.92% respectively. The results indicate that growth rate in fintech funding volume, number of fintech funding deals, and number of fintech startups are significant as their P-values are less than 0.05 which is the significance level used due to a confidence level of 95%. Also, NIITI, NIM, TETR, and TDTA are statistically significant for the three regression models. CPI is significant at 1% for the growth rate in fintech funding volume and the number of fintech startups regression models, while it's significant at 10% for the growth rate in the number of fintech funding deals regression model.

Table 5.2: Regression Model 1 Results
The Impact of Growth in Fintech Funding Volume and Bank ROA

ROA	Coeff.	Std. Err.	T-stat.	Sig.	R-squared	F-statistics
Growth in fintech funding	-.0016	.0005	-3.28	0.001***	79.41%	155.36*** (0.0000)
CPI	.1244	.0203	6.11	0.000***		
NIITI	.0573	.0256	2.24	0.025**		
NIM	.5059	.0707	7.16	0.000***		
TETR	-.0449	.0145	-3.09	0.002***		
TDTA	.0433	.0205	2.12	0.034**		
Constant	-.0112	.0267	-0.42	0.675		

The table reports the estimated coefficients, their heteroscedasticity-robust t-statistics, their p-values, the overall R-squared statistic, and the regression equation F-statistics and its p-value. * denotes significance at the 10 percent level, ** denotes significance at the 5 percent level, and *** denotes significance at the 1 percent level.

Table 5.3: Regression Model 2 Results
The Impact of Growth in the Number of Fintech Funding Deals and Bank ROA

ROA	Coeff.	Std. Err.	T-stat.	Sig.	R-squared	F-statistics
Growth in fintech funding	.0082	.0024	3.41	0.001***	78.66%	159.36*** (0.0000)
CPI	-0.664	.0402	-1.65	0.098*		
NIITI	.0509	.0259	1.97	0.049**		
NIM	.5366	.0715	7.50	0.000***		
TETR	-.0431	.0145	-2.98	0.003***		
TDTA	.0446	.0204	2.19	0.029**		
Constant	-.0068	.0258	-0.26	0.792		

The table reports the estimated coefficients, their heteroscedasticity-robust t-statistics, their p-values, the overall R-squared statistic, and the regression equation F-statistics and its p-value. * denotes significance at the 10 percent level, ** denotes significance at the 5 percent level, and *** denotes significance at the 1 percent level.

Table 5.4: Regression Model 3 Results
The Impact of Growth in the Number of Fintech Startups and ROA

ROA	Coeff.	Std. Err.	T-stat.	Sig.	R-squared	F-statistics
Growth in fintech funding	.0019	.0006	3.07	0.002***	78.92%	157.62*** (0.0000)
CPI	.0526	.0103	5.11	0.000***		
NIITI	.0591	.0269	2.19	0.028**		
NIM	.5001	.0704	7.10	0.000***		
TETR	-.0465	.0146	-3.19	0.001***		
TDTA	.0423	.0204	2.07	0.038**		
Constant	-.0058	.0266	-0.22	0.828		

The table reports the estimated coefficients, their heteroscedasticity-robust t-statistics, their p-values, the overall R-squared statistic, and the regression equation F-statistics and its p-value. * denotes significance at the 10 percent level, ** denotes significance at the 5 percent level, and *** denotes significance at the 1 percent level.

Tables 5.5-5.7 present the regression results of the effect of each of the three examined fintech measures on bank ROE. Regarding the R-square, the ROE is explained by growth rate in fintech funding volume, number of fintech funding deals, and number of fintech startups by approximately 72.57%, 72.34%, and 71.98% respectively. The results indicate that growth rate in fintech funding volume, number of fintech funding deals, and number of fintech startups are significant. Also, NIM, TETR, and TDTA are statistically significant for the three models as their P-values are less than 0.05. However, NIITI is insignificant in the three models. Moreover, CPI is insignificant in the growth in the

number of fintech funding deals model, while it's significant in the other two models.

Table 5.5: Regression Model 4 Results
The Impact of Growth in Fintech Funding Volume and Bank ROE

ROA	Coeff.	Std. Err.	T-stat.	Sig.	R-squared	F-statistics
Growth in fintech funding	-.0133	.0046	-2.89	0.004***	72.57%	156.05*** (0.0000)
CPI	1.391	.2481	5.61	0.000***		
NIITI	.1252	.2804	0.45	0.655		
NIM	4.408	.6937	6.35	0.000***		
TETR	-.2642	.1154	-2.29	0.022**		
TDTA	.5142	.2377	2.16	0.031**		
Constant	-.2942	.2821	-1.04	0.297		

The table reports the estimated coefficients, their heteroscedasticity-robust t-statistics, their p-values, the overall R-squared statistic, and the regression equation F-statistics and its p-value. * denotes significance at the 10 percent level, ** denotes significance at the 5 percent level, and *** denotes significance at the 1 percent level.

Table 5.6: Regression Model 5 Results
The Impact of Growth in Fintech Funding Deals and Bank ROE

ROA	Coeff.	Std. Err.	T-stat.	Sig.	R-squared	F-statistics
Growth in number of fintech funding deals	.0734	.0223	3.29	0.001***	72.34%	165.89*** (0.0000)
CPI	-.2909	.3606	-0.81	0.420		
NIITI	.0769	.2784	0.28	0.782		
NIM	4.646	.6909	6.72	0.000***		
TETR	-.2463	.1162	-2.12	0.034**		
TDTA	.5263	.2314	2.27	0.023**		
Constant	-.2570	.2729	-0.94	0.346		

The table reports the estimated coefficients, their heteroscedasticity-robust t-statistics, their p-values, the overall R-squared statistic, and the regression equation F-statistics and its p-value. * denotes significance at the 10 percent level, ** denotes significance at the 5 percent level, and *** denotes significance at the 1 percent level.

Table 5.7: Regression Model 6 Results
The Impact of Growth in the Number of Fintech Startups and Bank ROE

ROA	Coeff.	Std. Err.	T-stat.	Sig.	R-squared	F-statistics
Growth in number of startups	.0163	.0063	2.58	0.010***	71.98%	159.70*** (0.0000)
CPI	.7789	.1445	5.39	0.000***		
NIITI	.1363	.2905	0.47	0.639		
NIM	4.380	.6821	6.42	0.000***		
TETR	-.2776	.1151	-2.41	0.016**		
TDTA	.5080	.2403	2.11	0.034**		
Constant	-.2503	.2815	-0.89	0.374		

The table reports the estimated coefficients, their heteroscedasticity-robust t-statistics, their p-values, the overall R-squared statistic, and the regression equation F-statistics and its p-value. * denotes significance at the 10 percent level, ** denotes significance at the 5 percent level, and *** denotes significance at the 1 percent level.

Tables 5.8-5.10 present the regression results of the effect of each of the three examined fintech measures on Bank Z-score. The Z-score is explained by the variables in the models of growth in fintech funding volume, number of fintech funding deals, and number of fintech startups by approximately 59.83%, 59.44%, and 60.29% respectively. The results indicate that the examined fintech measures have insignificant impact on banks' credit risk. Nevertheless, almost all the other examined determinants of banks' z-scores show significance similar to previous findings in the literature. TLTD is statistically insignificant; on the other hand, NIITI and NIM are statistically significant at 1% significance level. In addition, TETR and PNL are statistically significant at 5% significance level in the three models except in

the growth in fintech startups models, where PNL is significant at 1% significance level. CPI is significant in both the growth in the number of fintech funding deals and the number of fintech startups regression models, while it is insignificant in the growth in fintech funding volume regression model.

Table 5.8: Regression Model 7 Results
The Impact of Growth in Fintech Funding Volume and Bank Z-score

Z-score	Coeff.	Std. Err.	T-stat.	Sig.	R-squared	F-statistics
Growth in fintech funding Volume	-.0039	.0040	-0.97	0.343	59.83%	19.97*** (0.0000)
CPI	-.3934	.3309	-1.19	0.249		
NIITI	1.4127	.4163	3.39	0.003***		
NIM	4.2249	.8154	5.18	0.000***		
TETR	-.2793	.1188	-2.35	0.030**		
TLTD	-.1159	.1305	-0.89	0.385		
PNL	-.5676	.2025	-2.80	0.011**		
Constant	1.6452	.1098	14.99	0.000***		

The table reports the estimated coefficients, their heteroscedasticity-robust t-statistics, their p-values, the overall R-squared statistic, and the regression equation F-statistics and its p-value. * denotes significance at the 10 percent level, ** denotes significance at the 5 percent level, and *** denotes significance at the 1 percent level.

Table 5.9: Regression Model 8 Results
The Impact of Growth in Fintech Funding Deals and Bank Z-score

Z-score	Coeff.	Std. Err.	T-stat.	Sig.	R-squared	F-statistics
Growth in number of fintech funding deals	-.0001	.0162	-0.01	0.995	59.44%	16.65*** (0.0000)
CPI	-.5627	.2948	-1.91	0.072*		
NIITI	1.401	.4140	3.38	0.003***		
NIM	4.4802	.8099	5.53	0.000***		
TETR	-.2915	.1172	-2.49	0.022**		
TLTD	-.1270	.1365	-0.93	0.364		
PNL	-.5721	.2056	-2.78	0.012**		
Constant	1.6601	.1105	15.02	0.000***		

The table reports the estimated coefficients, their heteroscedasticity-robust t-statistics, their p-values, the overall R-squared statistic, and the regression equation F-statistics and its p-value. * denotes significance at the 10 percent level, ** denotes significance at the 5 percent level, and *** denotes significance at the 1 percent level.

Table 5.10: Regression Model 9 Results
The Impact of Growth in Fintech Startups and Bank Z-score

Z-score	Coeff.	Std. Err.	T-stat.	Sig.	R-squared	F-statistics
Growth in number of fintech startups	.0076	.0059	1.29	0.214	60.29%	21.64*** (0.0000)
CPI	-.5820	.2268	-2.57	0.019**		
NIITI	1.434	.4199	3.41	0.003***		
NIM	4.0850	.8170	5.00	0.000***		
TETR	-.2769	.1192	-2.32	0.031**		
TLTD	-.1124	.1270	-0.89	0.387		
PNL	-.5771	.1971	-2.93	0.009***		
Constant	1.6533	.1083	15.27	0.000***		

The table reports the estimated coefficients, their heteroscedasticity-robust t-statistics, their p-values, the overall R-squared statistic, and the regression equation F-statistics and its p-value. * denotes significance at the 10 percent level, ** denotes significance at the 5 percent level, and *** denotes significance at the 1 percent level.

6. Discussion

This paper examines the influence of fintech entrants on bank profitability and credit risk in Egypt from 2017 to 2021. The results of regression models employing ROA and ROE as the bank profitability measures show that fintech funding volume has a significant negative impact on bank profitability. This means that as fintech funding increases, bank profitability decreases. This negative association is comparable with the findings of previous research undertaken in emerging markets similar to

Egypt, such as Wonglimpiyarat (2017) and Phan et al. (2020), who studied Thailand and Indonesia, respectively. Furthermore, according to Monika et al. (2021) study conducted in Indonesia, fintech firms have an inverse effect on the profitability of government banks.

The regression results, on the other hand, are inconsistent with the Li et al. (2017) study, which was conducted in a developed market, the United States. According to Li et al. (2017), fintech investments have a strong positive impact on bank financial performance. Li et al. (2017) use bank share prices to assess bank financial performance, which is not the financial performance measure examined in this study. As a result, this could explain the contradiction in the findings.

Moreover, the rationale behind the negative impact of fintech funding volume on the profitability of banks in Egypt can be explained by the fact that large Egyptian banks are the main funding sources of fintech startups. For example, according to Central Bank of Egypt (2022a), the National Bank of Egypt, Bank du Caire, and Bank Misr established an investment fund worth 1.3 billion Egyptian pounds to support innovation and fund fintech and fintech-enabled startups with the aim that this fund becomes the largest fintech focused fund in the region. In this study, the National Bank of Egypt, Bank Misr, Banque du Caire, and other large banks are included among the 20 banks of the sample. Therefore, the impact of their massive funding contributions to the fintech industry might have negatively impacted their profits throughout the past years. This would explain the significant inverse relationship between the rise of fintech funding in Egypt and bank profitability.

Moreover, studies conducted in Indonesia supports the findings of a negative relationship because banks are the leading funding providers for fintech entrants in Indonesia as well. According to MEDICI (2021), there is a deep collaboration between fintech startups and Indonesian banks. Large banks in Indonesia set up venture capital funds and incubators to invest in fintech startups, some of which are BCA, Bank Mandiri, Bank

Rakyat, Bank CIMB Niaga, and Bank Bukopin. Consequently, the robustness of the negative impact of fintech funding on bank profitability, particularly in developing economies, is demonstrated. On the other hand, another rationale behind the negative relationship can be due to the short study period of this paper, from 2017 to 2021. As a result, bank funding for fintech and fintech-enabled firms did not take long enough to demonstrate its benefits to bank profitability, resulting in a negative association.

Moreover, the findings of the regression reveal a significant positive relationship between bank profitability and number of fintech startups as well as number of fintech funding deals using both profitability measures, ROA and ROE. This implies that when the number of fintech entrants increases in Egypt, the profitability of banks is positively impacted. Moreover, when the number of fintech funding deals increases, bank profitability increases.

These findings are consistent with the results of Li et al. (2017) as they claim that growing number of startups and fintech funding deals have a significant and positive impact on share price of bank; thus, improves bank performance in United States. The measures used in this paper for growth of fintech startups and growth of fintech funding deals are same as in Li et al. (2017) study. Moreover, the study period of the thesis is 5 years; on the other hand, Li et al. (2017) study period is 6 years, revealing that both studies are conducted on short periods due to limitation of data. Thus, this would explain the consistency in the results.

In addition, the findings of this study regression models are also consistent with studies of Haddad and Hornuf (2021), Chahaidar et al. (2021), and Ibrahim (2018) that are conducted on 87 different countries (including developed and developing countries), European countries, and Kenya respectively. Those studies claim that fintech startups have a significant positive impact on bank profitability using net interest margin, ROA, ROE, Tobin's Q, and annual stock return as profitability measures. However, results are inconsistent with Abu Karash and

Abufara (2020) as they state that fintech has an insignificant impact on bank profitability, the study was conducted on Kenyan and Lithuanian banks.

The rationale behind the positive impact of the growth in the number of fintech startups and number of fintech funding deals on bank profitability is that emerging fintech firms in the market increases competition, putting pressure on banks because the services offered by fintech firms are similar to those provided by banks, particularly payment and lending services. According to Central Bank of Egypt (2022a), payment and remittance fintech firms represent 30% of the total number of fintech firms in Egypt. Furthermore, lending fintech firms account for 15% of total fintech firms. Thus, banks in Egypt started to adopt fintech in their offered services in order to compete in the market and achieve the same degree of innovation as fintech startups. This rationale is consistent with the findings of Jakšič and Marinč (2019) who state that the expansion of information technology and the competitive pressure created by fintech startups benefit bank stability.

Moreover, the explanation behind the positive impact of the growth in the number of fintech startups and fintech funding deals on bank profitability may be indirect. The key drivers for achieving financial inclusion in Egypt are banking digital transformation and the use of fintech in the delivery of financial services (Hussein, 2020). According to Alshehadeh and Al-Khawaja (2022), financial inclusion has a positive effect on bank profitability in Egypt. Thus, the growth in the number of fintech firms and fintech funding deals could have positive impact on bank profitability through enhancing financial inclusion in the Egyptian economy.

Regarding bank credit risk, the results of the regression revealed an insignificant relationship between banks' Z-score and the growth rate in fintech funding, number of fintech startups, and number of fintech funding deals. This demonstrates that there is no relationship between fintech entrants and bank credit risk. These results are inconsistent with studies conducted in China by Wang and Wu (2018), Pierri and Timer (2020), and Deng et al.

(2021). Moreover, the findings contradict Haddad and Hornuf's (2021) study, which is conducted in 87 countries (both developing and developed countries). According to these studies, fintech has a robust impact on the level of risk taking in banks. The studies reveal that development of fintech startups enhances bank risk management and reduces banks' exposure to systemic risk.

The justification behind the insignificant impact of fintech on bank credit risk in this study can be attributed to the characteristics of the sample period employed. The five-year sample period spans the two years of the COVID-19 pandemic, which had a significant impact on bank risk. As a result, all banks' Z-scores were extremely erratic as shown in the descriptive statistics displayed in table 5.1. Consequently, the results of the regression models examining the impact of fintech on bank credit risk might have been influenced by the extreme value of banks' Z-scores.

7. Conclusion and Recommendations

The objective of this study is to examine the impact of fintech on bank profitability and credit risk in Egypt during a five-year period, from 2017 to 2021. To ensure the robustness of the findings, both ROA and ROE are employed to assess bank profitability. Moreover, the growth in fintech funding volume, growth in the number of fintech startups, and growth in the number of fintech funding deals are used to measure fintech. In addition, the Z-score is utilised to assess bank credit risk. Moreover, control variables, including internal and external variables, are employed in the regression analysis to control for differences between banks in each regression model. As a result, three dependent variables are examined, with the three fintech measures used alternately as independent variables for each dependent variable, resulting in nine regression models.

The findings reveal that the growth in the number of fintech startups and the number of fintech funding deals have a significant positive impact on bank profitability. The justification

for this relationship is the growing competition in the banking industry which encourages banks to incorporate fintech in their activities and engage in banking digital transformation. This leads to improved and more convenient services to customers, which enhances bank profitability. Thus, findings of this paper are supported by the consumer theory and disruptive innovation theory as illustrated in section 3.

On the other hand, the growth in fintech funding volume shows a significant negative relationship with bank profitability. The reasoning behind this relationship might be attributed to the fact that several banks in Egypt are considered as the primary source of funding for fintech and fintech-enabled startups, which could have a negative impact on bank profitability, particularly on the short-term. However, considering the impact of the growth in the number of fintech startups and number of fintech funding deals on bank profitability, it is clear that banks are highly benefiting from the existence of fintech firms. As a result, banks' profitability improves. Moreover, fintech does not have significant impact on bank credit risk. However, the occurrence of COVID-19 pandemic over the last two years in the five-year sample period might have resulted in a highly volatile Z-scores. As a result, the regression model results for Z-score and fintech variables may have been negatively affected.

The Central Bank of Egypt could find this study of great value, as the Central Bank of Egypt must continue to pay close attention to fintech and fintech firms by supporting and funding them. Based on the findings of this study, the CBE's encouragement to fund and promote more fintech firms will not only encourage more fintech firms to emerge and function in the market, but will also contribute to increased bank profitability in Egypt.

Moreover, according to the findings of this study, bank management should adopt digital transformation and offer fintech solutions to gain a competitive advantage and adapt to changing market needs. Customers nowadays are searching for services that are simple to use and convenient, and they have found this in the

services provided by fintech firms. As a result, bank executives should devise new strategies to capitalize on the development of the fintech industry. This can be accomplished by developing their own fintech solutions, outsourcing fintech services, forming joint ventures with fintech firms, or acquiring fintech startups.

Furthermore, the study's findings are important for the literature since they will shed light on the influence of fintech entrants on bank profitability and credit risk in Egypt. Additionally, this article investigates a new determinant of bank profitability known as 'fintech,' which has not been addressed before in the Egyptian market. Furthermore, the study employs three measures of fintech firms that have not been employed before in researches conducted in Egypt. Thus, the study serves as a guide for future research on this topic in Egypt.

As a result of the paper findings, it is recommended to reexamine the influence of fintech on bank credit risk across a longer sample period in order to offset the effect of COVID-19 pandemic on bank Z-score values. Furthermore, to ensure the robustness of future findings, it is suggested for forthcoming studies to employ other credit risk indicators in addition to Z-scores, such as the non-performing loans ratio.

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